AMENDMENT NO. 2 FEBRUARY 2021

TO

IS 11329 : 2018 FINNED TYPE HEAT EXCHANGER FOR ROOM AIR CONDITIONER

(First Revision)

[*Page* 1, *clause* **1** (*see also Amendment No*. 1)] — Substitute the following for the existing clause:

‘1 SCOPE

This standard specifies the general requirement and method of tests for finned type heat exchangers used for the manufacturing of room air conditioners up to and including the capacity of 18 000 W.

NOTE — The heat exchanger for air-conditioners other than IS 1391 (Part 1) and (Part 2) is under consideration.’

[*Page* 3, *clause* **5.1** (*see also Amendment No*. 1)] — Substitute the following for the existing clause:

‘5.1 Tube Material

The material for the tube shall be of copper or aluminium and shall conform to the relevant standard or Annex as described below:

a) *Copper tube* — Copper tube shall conform to IS 10773 or as per the requirements listed in Annex B.

b) *Aluminium tube* — Aluminium tube material shall conform to Annex C.’

[*Page* 3, *clause* **5.2** a) (*see also Amendment No*. 1] — Substitute the following for the existing :

‘a) *Aluminium fin* — Aluminium fin material shall conform to Annex C.’

[*Page* 4, *clause* **6.1**, line 4 (*see also Amendment No.* 1)] — Substitute '72 h' *for* 'one day'.

[*Page* 6, *clause* **7.2.1** (*see also Amendment No.* 1)] — Substitute the following for the existing clause:

'**7.2.1** *Water Leak Test*

All heat exchanger shall be subjected to nitrogen or dry air with a minimum pressure of 2.942 MPa or design pressure as declared by the manufacturer, whichever is lower shall be selected as the test pressure.

Water leak test shall be carried as described below:

a) Close the open ends with dead-end plugs and provide shut-off valve on the other end of the heat exchanger or insert all open connection tubes into the nozzle of the shut-off valve.
b) Connect the coupler to the shut-off valve and pressurize with nitrogen or dry air with a minimum -40°C dew point according to the pressure specified in **7.2.1**.
c) Submerge the heat exchanger in the water tank and hold for 30 s. Check for the air bubbles.

If no bubble is detected during the testing, the heat exchanger is considered to conform.'

[Page 6, *clause* **7.2.2** (*see also Amendment No.* 1)] — Substitute the following for the existing clause:

'**7.2.2** *Helium Leak Test*

Helium is used as a tracer gas. It is sensitive to detect minute leaks in heat exchanger assemblies.

The leak test is done by the chamber test method or sniffer test method as described below:

a) *Chamber test method:*
    1) Place the heat exchanger inside the chamber and close the door;
    2) Fill the heat exchanger with helium gas at min 1 MPa; and
    3) The leak rate of helium gas from any surface of the heat exchanger shall not be more than 2.51×10^{-5} atm-cc/sec (2.51×10^{-5} mbar.l/s).

b) *Sniffer test method:*

1) The heat exchanger is pressurized with helium gas. If required due to large volume, the tracer gas concentration could be 20 percent by volume;
2) Unless otherwise specified, components which are to be pressure leak-tested shall be pressurized to a minimum of 0.42 MPa (60 psi) or 15 percent maximum allowable design pressure, whichever is less, and held at this pressure for sufficient time till equilibrium is reached;
3) The tip of the probe should be within 5 mm of the surface being scanned. Normally a sniffer probe speed of around 25cm/min or less is recommended; and
4) The leak rate of helium gas from any surface shall not be more than 2.51×10^{-5} atm-cc/sec (2.51×10^{-5} mbar.l/s).

The correction for the concentration of tracer gas (helium) could be calculated as follows:

$$\frac{\text{Measured leak rate} \times 100}{\text{Percent He Gas}} = \text{Actual leak rate.'}$$

[*Page* 6*, clause* **7.2.3** c) (*see also Amendment No.* 1)] — Substitute the following for existing:

'c) Vacuum shall be done till the heat exchanger pressure reading reaches a maximum of 0.05 Torr. The mentioned pressure shall be achieved within 60 s'.

(*Page* 6, *clause* **7.3,** *line* 4) — Substitute 'burst test or fatigue strength test' *for* 'strength or fatigue strength test'.

(*Page* 6, *clause* **7.3.1**, *para* 2, *sentence* 1) — Substitute the following for existing:

'The test samples are to be filled with non-compressible fluid like water/ oil and are to be connected in a hydraulic pump system/ pressure driving source.'

[*Page* 6, *clause* **7.3.2** (*see also Amendment No.* 1)] — Substitute the following for the existing:

'**7.3.2** *Fatigue Strength Test*

A fresh sample for the cyclic test shall be taken. The heat exchanger shall withstand two times the design pressure for 1 min prior to the cycle test and there shall not be any visible leak, rupture or burst.

The test sample shall be filled with non-compressible fluid like water/ oil and shall be connected to a pressure driving source. The pressure shall be raised and lowered between the upper and lower cyclic values at a rate specified by the manufacturer for a total number of 250 000 cycles. The entire specified pressure excursion shall occur during each cycle.

The following test pressures shall be applied:

a) For the first cycle, the PS for the low-pressure side components or the PS for the high-pressure side components shall be applied;

b) For the test cycles, the upper pressure value shall not be less than 0.7 times design pressure and the lower pressure value shall not be greater than 0.2 times design pressure; and

c) For the final test cycle, the test pressure shall be increased to 1.4 × PS (two times of 0.7 × PS). The pressure shall be 1.8 × PS (two times of 0.9 × PS) for water heat exchangers in the heat pump.

NOTES

1 For safety purposes, it is suggested to use a non- compressible fluid.

2 PS (maximum allowable pressure) is the maximum pressure which the system or component is designed, as specified by the manufacturer.

After completion of the fatigue test, the heat exchanger shall withstand min 1.5 times the design pressure for 1 min and there shall not be any visible leak or burst.

[*Page* 8, *clause* **7.4.5.2** a) (*see also Amendment No.* 1)] — Insert the following note at the end of the clause:

NOTE — If the size of the heat exchanger is large and not able to fit into the salt spray chamber, then the manufacturer can prepare a small replica of the heat exchanger (which meets design and process intent) and proceed for salt spray test.

(*Page* 8, *clause* **7.4.5.2,** *last para*) — Delete.

(*Page* 9, *Annex A*) — Insert the following new annexes:

ANNEX B

(*Clause* 5)

COPPER MATERIAL REQUIREMENT

B-1 CHEMICAL COMPOSITION (wt. percent)

Elements	C12200 / C1220T
Cu	99.90 *min*
Pb	—
Sn	—
Fe	—
Al	—
Mn	—
As	—
Ni	—
Zn	—
P	0.015-0.040

B-1.1 Test Method

The sample is dissolved in an acid mixture and the copper is electrolytically deposited and weighted on a tared platinum cathode. Copper remaining in the electrolyte is determined by the atomic absorption spectroscopy method. *See* IS 440 or ISO 1554 for the test method.

B-2 TENSILE TEST

Performance requirements:

Condition	*Tensile Strength* (Mpa)	*Percentage Elongation* (For wall thickness > 0.508 mm)
Soft annealed	205 *min*	40 *min*
Light annealed	205 *min*	40 *min*
Light drawn	245-325	—

NOTE — The elongation requirements for a copper tube having wall thickness < 0.508 mm shall be as per the agreement between the purchaser and the supplier.

B-2.1 Test Method

The test shall be carried in accordance with IS 1608 (Part 1) : 2018/ISO 6892-1 : 2016.

B-3 FLATTENING TEST

Cut the test piece of about 100 mm in length from the tube end. Place the test piece between two flat plates as shown in Fig. 7 and flatten it until the distance between the plates are less than three times the wall thickness of the tube.

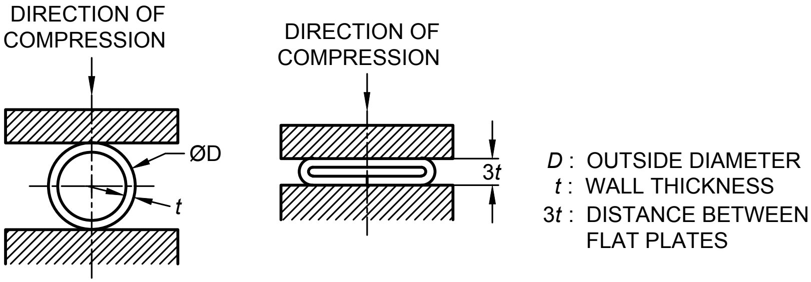

Fig. 7 Flattening Test

B-3.1 Test Method

The test shall be carried in accordance with IS 2328 : 2018/ISO 8492 : 2013.

B-3.2 Performance Requirements

The flattened tube shall show no cracks / ruptures through visual inspection without the use of special equipment / enhancement.

B-4 EXPANSION TEST

Annealed tubes shall be capable of withstanding an expansion of the outside diameter.

Conical mandrel / pin angle = 60°

Outer Diameter, mm	*Expansion*, *min* percent
Up to and including 20	40
Over 20 - 100	30

NOTE — This test is not applicable for the inner grooved copper tube.

B-4.1 Test Method

Test shall be carried in accordance with IS 2335 : 2005/ISO 8493 : 1998.

B-4.2 Performance Requirements

The expanded shall show no cracks / ruptures through visual inspection without the use of special equipment / enhancement.

B-5 PNEUMATIC TEST

Each tube shall be capable to withstanding the minimum internal air pressure of 0.4 Mpa for at least 5 s without any leakage.

B-5.1 Test Method

Test shall be carried in accordance with **10.4.3** of IS 10773.

B-6 GRAIN STRUCTURE

The grain structure for copper shall be as follows:

Light annealed	:	0.040 mm, *Max*
Soft annealed	:	0.025 - 0.060 mm

B-6.1 Test Method

Test shall be carried in accordance with IS 4748 : 2009/ISO 643 : 2003.

ANNEX C

(*Clause* 5)

ALUMINIUM MATERIAL REQUIREMENT

C-1 MECHANICAL PROPERTIES

C-1.1 Tensile Strength

The material shall conform to the following requirement:

Tensile Strength (Mpa)	*Percent Elongation*
Min 55 MPa	*Min* 1 percent

C-1.2 Test Method

The test shall be carried in accordance with IS 1608 (Part 1) : 2018/ISO 6892-1 : 2016.

(MED 03)

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